



## SEQUENCE LISTING

<110> Board of Trustees for University of Arkansas

<120> Mitogen-Activated Protein Kinase and Method of Use to Enhance Biotic and Abiotic Stress Tolerance in Plants

<130> UAF-03-14

<140> 60/444,249

<141> 2004-01-31

<160> 10

<170> PatentIn version 3.2

<210> 1

<211> 1396

<212> DNA

<213> Oryza sativa

<400> 1

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acggcgggccg gtacctgctc tacgacatct tcgggaacaa gttcgagggtg acgaacaagt	180
accagccgcc catcatgccc attggccgcg gcgcctacgg gatcgtctgc tccgtgatga	240
actttgagac gaggggagatg gtggcgataa agaagatcgc caacgcgttc aacaacgaca	300
tggacgcaa ggcacgctc cgggagatca agctcctcag gcacctcgac cagagaaca	360
tcataggcat cagggatgtg atcccgcgcg cgatccctca ggcgttcaac gacgtctaca	420
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cggcgaacgt gatccaccgc gacctgaagc cgagcaacct gctgctgaac gccaaactgcg	600
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<210> 2
<211> 368
<212> PRT
<213> Oryza sativa

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<400> 2

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Gly Arg Tyr Leu Leu Tyr Asp Ile Phe Gly Asn Lys Phe Glu Val Thr
          20          25          30

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```

Asn Lys Tyr Gln Pro Pro Ile Met Pro Ile Gly Arg Gly Ala Tyr Gly
          35          40          45

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```

Ile Val Cys Ser Val Met Asn Phe Glu Thr Arg Glu Met Val Ala Ile
          50          55          60

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Lys Lys Ile Ala Asn Ala Phe Asn Asn Asp Met Asp Ala Lys Arg Thr
65          70          75          80

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Leu Arg Glu Ile Lys Leu Leu Arg His Leu Asp His Glu Asn Ile Ile
          85          90          95

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Gly Ile Arg Asp Val Ile Pro Pro Pro Ile Pro Gln Ala Phe Asn Asp
          100          105          110

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Val Tyr Ile Ala Thr Glu Leu Met Asp Thr Asp Leu His His Ile Ile
          115          120          125

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Arg Ser Asn Gln Glu Leu Ser Glu Glu His Cys Gln Tyr Phe Leu Tyr  
130 135 140

Gln Ile Leu Arg Gly Leu Lys Tyr Ile His Ser Ala Asn Val Ile His  
145 150 155 160

Arg Asp Leu Lys Pro Ser Asn Leu Leu Leu Asn Ala Asn Cys Asp Leu  
165 170 175

Lys Ile Cys Asp Phe Gly Leu Ala Arg Pro Ser Ser Glu Ser Asp Met  
180 185 190

Met Thr Glu Tyr Val Val Thr Arg Trp Tyr Arg Ala Pro Glu Leu Leu  
195 200 205

Leu Asn Ser Thr Asp Tyr Ser Ala Ala Asp Val Trp Ser Val Gly Cys  
210 215 220

Ile Phe Met Glu Leu Ile Asn Arg Gln Pro Leu Phe Pro Gly Arg Asp  
225 230 235 240

His Met His Gln Met Arg Leu Ile Thr Glu Val Ile Gly Thr Pro Thr  
245 250 255

Asp Asp Glu Leu Gly Phe Ile Arg Asn Glu Asp Ala Arg Lys Tyr Met  
260 265 270

Arg His Leu Pro Gln Tyr Pro Arg Arg Thr Phe Ala Ser Met Phe Pro  
275 280 285

Arg Val Gln Pro Ala Ala Leu Asp Leu Ile Glu Arg Met Leu Thr Phe  
290 295 300

Asn Pro Leu Gln Arg Ile Thr Val Glu Glu Ala Leu Asp His Pro Tyr  
305 310 315 320

Leu Glu Arg Leu His Asp Ile Ala Asp Glu Pro Ile Cys Leu Glu Pro  
325 330 335

Phe Ser Phe Asp Phe Glu Gln Lys Ala Leu Asn Glu Asp Gln Met Lys  
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Gln Leu Ile Phe Asn Glu Ala Ile Glu Met Asn Pro Asn Ile Arg Tyr  
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<210> 3  
 <211> 1084  
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 accagccgcc catcatgccc attggccgcg gcgcctacgg gatcgtctgc tccgtgatga 240  
 actttgagac gaggggagatg gtggcgataa agaagatcgc caactgacac ctcaagatct 300  
 gcgacttcgg gctggcgcg cgcgtcgtcg agagcgacat gatgacggag tacgtggtca 360  
 cccggtggta ccgcgcgcg gagctgctgc tcaactccac cgactactcc gccgccatcg 420  
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 gcagggacca catgcaccag atgcgcctca tcaccgaggt gatcgggacg ccgacggacg 540  
 acgagctggg gttcatacgg aacgaggacg cgaggaagta catgaggcac ctgccgcagt 600  
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 atccttacct agagagattg cagacatcg ccgatgagcc catctgcctg gagcccttct 780  
 ccttcgactt cgagcagaag gctctaaacg aggaccaa atgaagcagctg atcttcaacg 840  
 aagcgatcga gatgaacca aacatccggt actagattga atcaccatgg aaatgagatc 900  
 ccgtctatac ctgctttgta catatgatca agattgagag ccgggtagac tgaacattgc 960  
 atttgtttgt ttgttgatgt tcgaaaccca cattctctgc aagttgtggc tgctttgtat 1020  
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<210> 4  
 <211> 266  
 <212> PRT  
 <213> Oryza sativa

<400> 4

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20 25 30

Thr Asn Lys Tyr Gln Pro Pro Ile Met Pro Ile Gly Arg Gly Ala Tyr  
35 40 45

Gly Ile Val Cys Ser Val Met Asn Phe Glu Thr Arg Glu Met Val Ala  
50 55 60

Ile Lys Lys Ile Ala Asn Cys Asp Leu Lys Ile Cys Asp Phe Gly Leu  
65 70 75 80

Ala Arg Pro Ser Ser Glu Ser Asp Met Met Thr Glu Tyr Val Val Thr  
85 90 95

Arg Trp Tyr Arg Ala Pro Glu Leu Leu Leu Asn Ser Thr Asp Tyr Ser  
100 105 110

Ala Ala Ile Asp Val Trp Ser Val Gly Cys Ile Phe Met Glu Leu Ile  
115 120 125

Asn Arg Gln Pro Leu Phe Pro Gly Arg Asp His Met His Gln Met Arg  
130 135 140

Leu Ile Thr Glu Val Ile Gly Thr Pro Thr Asp Asp Glu Leu Gly Phe  
145 150 155 160

Ile Arg Asn Glu Asp Ala Arg Lys Tyr Met Arg His Leu Pro Gln Tyr  
165 170 175

Pro Arg Arg Thr Phe Ala Ser Met Phe Pro Arg Val Gln Pro Ala Ala  
180 185 190

Leu Asp Leu Ile Glu Arg Met Leu Thr Phe Asn Pro Leu Gln Arg Ile  
195 200 205

Thr Val Glu Glu Ala Leu Asp His Pro Tyr Leu Glu Arg Leu His Asp

# MAPK5.ST25

210		215		220
Ile Ala Asp Glu Pro Ile Cys Leu Glu Pro Phe Ser Phe Asp Phe Glu				
225		230	235	240
Gln Lys Ala Leu Asn Glu Asp Gln Met Lys Gln Leu Ile Phe Asn Glu				
	245		250	255
Ala Ile Glu Met Asn Pro Asn Ile Arg Tyr				
	260		265	

<210> 5  
<211> 26  
<212> DNA  
<213> Artificial

<220>  
<223> gene-specific primer containing restriction site

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26

<210> 6  
<211> 25  
<212> DNA  
<213> Artificial

<220>  
<223> gene-specific primer containing restriction site

<400> 6  
gctctagatt caatctagta ccgga

25

<210> 7  
<211> 20  
<212> DNA  
<213> Artificial

<220>  
<223> gene-specific primer containing restriction site

<400> 7  
gagttcaggc cgacgatgac

20

<210> 8  
<211> 20  
<212> DNA  
<213> Artificial

<220>

<223> gene-specific primer containing restriction site

<400> 8

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<210> 9

<211> 368

<212> PRT

<213> Triticum aestivum

<400> 9

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20 25 30

Ala Lys Tyr Gln Pro Pro Ile Met Pro Ile Gly Lys Gly Ala Tyr Gly  
35 40 45

Ile Val Cys Ser Val Met Asn Phe Glu Thr Arg Glu Met Val Ala Ser  
50 55 60

Lys Lys Ile Ala Asn Ala Phe Asp Asn Asn Met Asp Ala Lys Arg Thr  
65 70 75 80

Leu Arg Glu Ile Lys Leu Leu Leu Arg His Leu Asp Glu Asn Ile Val  
85 90 95

Gly Leu Arg Asp Val Ile Pro Pro Ala Ile Pro Gln Ser Glu Asn Asp  
100 105 110

Val Tyr Ile Ala Thr Glu Leu Met Asp Thr Asp Leu His His Ile Ile  
115 120 125

Arg Ser Asn Gly Glu Leu Ser Glu Glu His Glu Gln Tyr Phe Leu Tyr  
130 135 140

Gln Leu Leu Arg Gly Leu Lys Tyr Ile His Ser Ala Asn Val Ile His  
145 150 155 160

Arg Asp Leu Lys Pro Ser Asn Leu Leu Leu Asn Ala Asn Cys Asp Leu  
165 170 175

Lys Ile Cys Asp Phe Gly Leu Ala Arg Pro Ser Ser Glu Ser Asp Met  
180 185 190

Met Thr Glu Tyr Val Val Thr Arg Trp Tyr Arg Ala Pro Glu Leu Leu  
195 200 205

Leu Asn Ser Thr Asp Tyr Ser Ala Asn Ile Asp Val Trp Ser Val Gly  
210 215 220

Cys Ile Phe Met Glu Leu Ile Asn Arg Ala Pro Leu Phe Pro Gly Arg  
225 230 235 240

Asp His Met His Gln Met Arg Leu Ile Thr Glu Val Ile Gly Thr Pro  
245 250 255

Thr Asp Asp Asp Leu Gly Phe Ile Arg Asn Glu Asp Ala Arg Arg Tyr  
260 265 270

Met Arg His Leu Pro Gln Phe Pro Arg Arg Ser Phe Pro Gly Phe Pro  
275 280 285

Lys Val Gln Pro Ala Ala Leu Asp Leu Ile Glu Arg Met Leu Thr Phe  
290 295 300

Asn Pro Leu Gln Arg Ile Thr Val Glu Glu Ala Leu Glu His Pro Tyr  
305 310 315 320

Leu Glu Arg Leu His Asp Val Ala Asp Glu Pro Ile Cys Thr Asp Pro  
325 330 335

Phe Ser Phe Asp Phe Glu Gln His Pro Leu Thr Glu Asp Gln Met Lys  
340 345 350

Leu Ile Pro Glu Asn Glu Ala Leu Glu Leu Asn Pro Asn Phe Arg Tyr  
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<210> 10  
<211> 371  
<212> PRT



<213> Nicotiana tabacum

<400> 10

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20 25 30

Phe Gly Asn Phe Phe Glu Ile Thr Thr Lys Tyr Arg Pro Pro Ile Met  
35 40 45

Pro Ile Gly Arg Gly Ala Tyr Ile Val Cys Ser Val Leu Asn Thr Glu  
50 55 60

Leu Asn Glu Met Val Ala Val Lys Lys Ile Ala Asn Ala Phe Asn Tyr  
65 70 75 80

Met Asp Ala Lys Arg Thr Leu Arg Glu Ile Lys Leu Leu Arg His Leu  
85 90 95

Asp His Glu Asn Val Ile Gly Leu Arg Asp Val Ile Pro Pro Pro Leu  
100 105 110

Arg Arg Glu Phe Ser Asp Val Tyr Ile Ala Thr Glu Leu Met Asp Thr  
115 120 125

Asp Leu His Gln Ile Ile Arg Ser Asn Gln Gly Leu Ser Glu Asp His  
130 135 140

Cys Gln Tyr Phe Met Tyr Gln Leu Leu Arg Gly Leu Lys Tyr Ile His  
145 150 155 160

Ser Ala Asn Val Leu His Arg Asp Leu Lys Pro Ser Asn Leu Leu Val  
165 170 175

Asn Ala Asn Cys Asp Leu Lys Ile Cys Asp Phe Gly Leu Ala Arg Pro  
180 185 190

Asn Ile Glu Asn Glu Asn Met Thr Glu Tyr Val Val Thr Arg Trp Tyr  
195 200 205

Arg Ala Pro Glu Leu Leu Asn Ser Thr Asp Tyr Ser Ala Ala Ile Asp  
 210 215 220

Val Trp Ser Val Gly Cys Ile Phe Met Glu Leu Ile Asn Arg Lys Pro  
 225 230 235 240

Leu Phe Pro Gly Lys Asp His Ile His Gln Met Arg Leu Ile Thr Glu  
 245 250 255

Val Ile Gly Thr Pro Thr Glu Ala Asp Leu Gly Phe Leu Gln Asn Glu  
 260 265 270

Asp Ala Arg Arg Tyr Ile Arg Gln Leu Pro Gln His Pro Arg Gln Gln  
 275 280 285

Leu Ala Glu Val Phe Pro His Val Asn Pro Leu Ala Ile Asp Leu Val  
 290 295 300

Asp Lys Met Leu Thr Phe Asp Pro Thr Arg Arg Ile Glu Glu Ala Leu  
 305 310 315 320

Asp His Pro Tyr Leu Ala Lys Leu His Asp Ala Gly Asp Glu Pro Ile  
 325 330 335

Cys Pro Val Pro Phe Ser Phe Asp Phe Glu Gln Gln Gly Ile Gly Glu  
 340 345 350

Glu Gln Ile Lys Asp Met Ile Tyr Gln Glu Ala Leu Ser Leu Asn Pro  
 355 360 365

Glu Tyr Ala  
 370